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# Analysis of Link Reversal Routing Algorithms for Mobile Ad Hoc Networks

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## Abstract

Link reversal (*LR*) algorithms provide a simple mechanism for routing in communication networks whose topology is frequently changing, such as in mobile and ad hoc networks. A *LR* algorithm routes by imposing a direction on each network link such that the resulting graph is destination oriented (DAG). Whenever a node loses routes to the destination, it reacts by reversing some (or all) of its incident links.

This survey presents the worst-case performance analysis of *LR* algorithms from the excellent work of Costas Busch and Srikanta Tirthapura (*SIAM J. on Computing*, **35**(2):305-326, 2005). The *LR* algorithms are studied in terms of *work* (number of node reversals) and *time* needed until the algorithm stabilizes to a state in which all the routes are reestablished. The *full reversal* algorithm and the *partial reversal* algorithm are considered.

- The *full reversal* algorithm requires  $O(n^2)$  work and time, where  $n$  is the number of nodes that have lost routes to the destination. This bound is tight in the worst case.
- The *partial reversal* algorithm requires  $O(na^* + n^2)$  work and time, where  $a^*$  is a non-negative integral function of the initial state of the network. Further, the *partial reversal* algorithm requires  $\Omega(na^* + n^2)$  work and time.
- There is an inherent lower bound on the worst-case performance of *LR* algorithms:  $\Omega(n^2)$ . Therefore, surprisingly, the full reversal algorithm is *asymptotically optimal* in the worst-case, while the partial reversal algorithm is *not*; since  $a^*$  can be arbitrarily larger than  $n$ .

## Short Biography of Christian Lavault

Christian Lavault received the Ph.D degree in Mathematics from University Paris 11, Orsay, France, in 1975. He received the Doctor of Philosophy degree (*Thèse d'État*) in Computer Science from the Computing Department at the University Paris 11 in 1987. Currently, he is a full professor at the *Institut Galilée*, University Paris 13, and is director of the OCAD team of the Research Laboratory LIPN (CNRS, UMR 7030).

His research interests include applications of discrete Maths to Computer Science: complexity analysis of algorithms and data structures, analytic combinatorics, distributed computing, wireless communications, sensor networks.